

DOCUMENT RESUME

ED 220 155

JC 820 409

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 TITLE A Teacher's Guide to Memory Techniques.
 INSTITUTION Lane Community Coll., Eugene, Oreg.
 PUB DATE 82
 NOTE 7p.
 JOURNAL CIT Focus on Productivity; n7 p23-27 Spr 1982.
 EDRS PRICE MF01/PC01 Plus Postage.
 DESCRIPTORS Community Colleges; *Learning Processes; *Learning Theories; *Memorization; Memory; *Mnemonics; Recall (Psychology); Retention (Psychology); Two Year Colleges

ABSTRACT

To aid instructors in teaching their students to use effective methods of memorization, this article outlines major memory methods, provides examples of their use, evaluates the methods, and discusses ways students can be taught to apply them. First, common, but less effective, memory methods are presented, including reading and re-reading materials, recitation, intensive studying, and detailed organization and classification of new material. Next, encoding memory methods are reviewed, whereby words or concepts are translated into other, more easily remembered, forms. Methods are discussed for encoding concrete words; encoding abstract words phonetically or semantically; and encoding numbers through imagery. Then, organizational memory methods, which require the creation of an artificial method of organizing material, are outlined. Three of these methods provide pegs on which to hang concepts: the "method of loci" links items to be memorized to a previously prepared set of locations; the "peg-word method" involves taking the material, encoding it into images, and making a vivid picture linking the peg word to the item to be remembered; and the "first letter recording method." The next three methods, story mnemonics, link mnemonics, and the use of rhymes and songs, involve chain processes for aiding the memory. Finally, brief tips are provided for helping students to use memory techniques. (HB)

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A TEACHER'S GUIDE TO MEMORY TECHNIQUES

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Originally published in Focus on Productivity, No. 7, Spring 1982.



A Teacher's Guide To Memory Techniques

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Many of our students do poorly in school because they use poor techniques to memorize the knowledge we ask them to learn. Francis S. Bellezza reports in a good article on mnemonic ("assisting the memory") techniques that researchers have proven that students who use good mnemonic techniques get higher grades than students who do not. (See references.) Furthermore, it has been found that when teachers help their students learn to use effective methods of memorizing, their students achieve better.

However, many teachers do not use or know the major mnemonic techniques themselves. This article summarizes some of the major memory methods and offers suggestions as to how to use them well. It is brief because of space limits, so I recommend that readers also check some of the references listed at the end.

The Memory Devices Mentioned in the Article

- I. Common methods which are less effective.
 - A. Repeated input (read and reread a book)
 - B. Recitation or rehearsal (practice saying the material)
 - C. Understanding new material
 - D. Organizing and classifying new material
- II. Encoding Methods
 - A. Encode concrete words—visual imagery (or sound, feeling, etc.)
 - B. Encode abstract words
 1. Semantic encoding (origin into egg)
 2. Phonetic encoding (origin into orange)
 - C. Encode numbers
 1. Memorize number-word list ("one is a bun," etc.)
 2. Memorize a number-consonant system (one=d, t; etc.)
- III. Organizational mnemonics
 - A. Peg-type methods
 1. Method of Loci (mercury thermometer on tree)
 2. T-X-word method (hang images on pre-learned peg words)
 3. First-letter recoding (HOMES or 5 Great Lakes)

B. Chain-style methods

1. Story mnemonic ("I took a walk and came—Cam-brian—")
2. Link Mnemonic (AB, CB, CD, DE, etc.)
3. Rhymes and songs (the ABC song; I before E poem)

I. Common Methods Which Are Less Effective

A. Repeated Input: The person reads and rereads material. He or she reviews continually, trying to take it in again and again.

An example: a student reads a psychology chapter on learning theory and underlines important concepts, definitions, principles, and research findings. Later the student reviews by rereading the underlined material several times.

Evaluation: Not very effective. It is also slow. It has a low pay-off in comparison to the high amount of time rereading without adding recitation and other specific mnemonic techniques.

B. Recitation or Rehearsal: The person takes in material. Then he or she tries to state it without using cues from the book. The more frequently one recites it, the more firmly the person learns it.

Example: A student attempts to learn the symbols of some of the metals. So the student reads that Fe is iron, looks away from the book, says "Iron is Fe, Fe is Iron," several times, and checks the book for feedback on accuracy.

Evaluation: It works, but there are methods which can work faster and produce more permanent learning. People who learn by reciting material tend to forget it if time passes and the material loses its freshness.

How to apply it: You can safely recommend that students use recitation with feedback. It's much better however, if they use some of the better memory techniques described below and recite it then.

C. Understanding New Material: Many people try to learn new facts and ideas by studying them intensively with the goal of "really trying to understand it."

Example: A student of biology studies photosynthesis in leaves until he or she understands how it proceeds and why. The student analyzes word meanings, meditates on chemical laws involved, and figures out the causes, conditions, and consequences. And stops.

Evaluation: It is not an efficient way to deliberately memorize new information. But it does produce benefit because of the repeated input, recitation, and reorganization.

How to apply it: Warn the students that it is dangerous to stop studying after they understand a topic. Tell them to go further and memorize important material as well. People should learn in two phases: (1) understand it and (2) memorize it.

D. Organizing and Classifying New Material: Many people think over new material, classify a number of facts and concepts according to a few

classifications. Then they memorize each item as one of the instances of the higher-order classification. They often draw diagrams showing the organization.

Example: A geology student had a large list of minerals to learn. By classifying them into logical groups, the memory task was easier.

Evaluation: This method is much superior to methods that result in piece-by-piece memorizing. It produces multiple associations to each item. It works even better when a person first organizes material and then deliberately uses other memory methods, too.

How to apply it: Recommend that your students look for ways to organize material they are learning. Suggest they hunt for similarities, differences, trends (increasing size, decreasing power), higher order classifications, and other patterns. Tell them to memorize the organization as well as the items.

II Encoding Memory Methods

What does *encoding* mean? It means that the person translates the word or number to be memorized into another form. If a person trying to remember *liberty* thinks of the Liberty Bell in Philadelphia, he or she has encoded the concept. If a student learning the sociological term *dysfunctional* thinks of a Brooklyn gangster muttering "Dis is fun" as he robs a bank, which is dysfunctional for society, the student has encoded the concept.

Encoding methods do not actually produce much memory by themselves. Instead, people encode things as a prerequisite to using other methods. This material on encoding is extremely important. If a person can encode ideas well, the incredible memory power opens up.

A. Encoding Concrete Words: Concrete words are words which refer to specific objects and events in this world, for which the person can imagine a specific picture, sound, or feeling. The concept of a small brown puppy yipping is concrete, but the concept of the four social system prerequisites of adaptation, gratification, integration, and latency is highly abstract. The way to encode concrete words is deliberately to think of an image, a sound, a feeling, a smell, or a taste that represents the word. Usually people use visual imagery, but they can get good memory with other senses, too. It is possible to encode one-shot concepts (like a purple cow) or complex concepts (like a rodeo parade) which require several pictures to represent.

B. Encoding Abstract Words: The problem for students trying to encode abstract ideas is that they lack confident pictures. Consider concepts like functional, progress, differentiated, and justice. They are difficult to represent visually in their full meaning. How can they be encoded? People usually use two ways:

1. Semantic encoding: One thinks of another word or a picture (or sound, smell, etc.) that has ap-

proximately the same meaning as the concept. Bellezza uses the word origin as an example. Since origins imply beginnings in general, one could use an egg as a symbol for origin. If you memorize origin as an egg, then later when remembering it, you would mentally see the egg and then associate it to origin.

2. Phonetic Encoding: This method depends upon puns or close verbal associations. You think of a word with high imagery possibilities (or a clear sound, taste, etc.) that sounds like the word you wish to remember. If the word is *origin* again, one could think of *orange* and then imagine a picture of one. Later when trying to remember it, you would see the orange, associate to the word *orange* and then back to origin. Believe me, it is immensely easier to do than it sounds in cold print.

How to use Semantic and Phonetic Encoding: Nearly always you will want to learn that two or more things are linked together. For example, suppose you want to learn that "Augusta is Maine's capital." You encode the words into high-imagery pictures and create one unified image. Let the image clearly include both elements. For example, if I think of Maine, I encode it as a cold man shivering (I lived there), and I can create an image of it as cold in August to represent Augusta. Augusta becomes August by the sounds (phonetic encoding), and Maine becomes a cold man shivering by semantic encoding. Strangely enough, most people can quickly interpret what the most bizarre mental images mean and remember their original material.

People are much more able to remember dramatic visual images that incorporate a fact than they can recall words and sentences that state the same facts. It's just the way the brain works.

It is easy to learn the meaning of foreign words by using phonetic encoding. You first make a picture of the English word. Then you look at the foreign word and use its sound to think of an English word it reminds you of. Finally, you build a unified picture to link the two words. For example, the word *dog* is *le chien* in French. *Chien* sounds like *skiing* to me. So I imagine a dog mounted on skis, skiing down a slope. Since the article *le* is masculine, I put a black beard on my mental image to make him male. Then I rehearse my image two or three times to make it solid. This is a far faster method of learning the word than is painful recitation.

C. Encoding Numbers: People often find it hard to remember numbers. But they can do it easily by encoding the numbers. Here are two common systems.

1. One can link the numbers to a list of specific words with high imagery value. Then one uses the images to build unified mental pictures linking the image to anything else. One system goes this way: One is a bun; two is a shoe; three is a tree; four is a door; five is a hive; six is sticks; seven is heaven, eight is a gate; nine is wine; ten is a hen. (Note the use of rhyme for quick memory. You could use non-rhyming words, but that list would be harder to link to the numbers.) Ob-

viously, this is a simple system for small numbers. The next system is more elegant and just as easy to use.

2. One can also memorize a list of consonants that match the numbers, and then use the consonants to make up vivid picture words that are different for each long number to remember. One common system goes this way: 0=s, z, and soft-c; 1=t and d; 2=n; 3=m; 4=r; 5=l; 6=j, soft-g, dg, ch, sch, and sh; 7=k and hard-c; 8=f and v; 9=p and b. You can easily remember it this way: 0123456789=Satan may relish coffee pie. You should remember that you go by the sounds and not the letters. If you want to remember a number that you have encoded this way, you recall the images, translate them into words, and then translate the consonants into numbers.

For example, Lane Community College's telephone number is 747-4501. The numbers encode into the consonants k, r, k, r, l, s, and t. It could become the words "car, car, lost" or "ache, rock, roll, sit." The to me, "car, car, lost" becomes a mental image of me standing on 30th Avenue near the big green LCC sign watching a car zoom past and off the road into the bushes, then a second car zoom past and into the bushes, and then I search for the cars and decide they're lost. Or "ache, rock, roll, sit" could become a mental image of my foot aching, then a big rock falling on it, then I roll over, and get up and sit down. (The *Memory Book* by Lucas and Lorayne has an excellent description of this method, starting on page 83 of the paperback edition.)

III. Organizational Memory Methods

All of the following methods require a person to create an artificial method of organizing the material. Usually the person uses one or more encoding techniques, too. The first three methods are peg types: the method of loci, peg-word mnemonics, and first-letter recoding. The next three methods are chain types: the story mnemonic, the link mnemonic, and rhymes.

A. Method of Loci: The word *loci* means places or locations. You link the items to be memorized to a previously prepared set of locations. You might take a building or a room or a familiar route and pick out a number of distinct places. Then you encode the material you want to learn into vivid images and place each one in one of the prepared locations. When you later wish to recall the items, you mentally visit each of the places and look at the item that you stored there.

For example, a student who wished to learn the nine planets in order could link each one to a place on the streets between his or her home and the local grocery store. First, he or she could hang a mercury thermometer on a tree by the first house, place a red heart-shaped pillow that represented Venus on the doorstep of the next house, imagine a pile of earth covering the lawn of the third house, and so on.

This method is highly effective. It originated in ancient times and was in common use for centuries by public speakers. When a student prepares a list of places, he or she must be meticulously careful to identify the exact places that will be used so as not to get mixed up. For example, if the student uses a familiar room, it is important to note which furniture will be used and which will not be.

How to apply it: You can recommend that students use it when they have any lists of things to remember. If they use a list twice or three times, the later uses can interfere with remembering what was used earlier.

B. Peg-Word Method: The phrase *peg-board* suggests a wall with pegs put in it and people hanging their clothes and tools on the pegs. Similarly, you prepare a series of peg-words, usually words with high imagery value, and associate the new material to the peg words. Usually, peg words and numbers are associated together so that people can learn new material in numerical sequences. The person can remember the material either in order or can remember the items out of order. The person can ask for item #12 and there it will be.

The method is simple. First, prepare the pegs. Then take the material, encode it into images, and make a vivid picture linking the peg word and the item to be remembered. For example, suppose item #7 was the writer Jane Austen. I could "seven is heaven," encode Austen as "ousting," and imagine an angry angel ousting an evil person from heaven by pushing the person off a cloud. When you need to remember the material, you think of the number, then the peg-word, and you will see the item you wanted because you had to put it into a picture unifying the two items.

Another example: A person could use the number-to-consonant method this way. Suppose a sociology student desired to memorize 10 effects of large size in human groups. One effect is that the people's communication is restricted because they don't have time to talk to all the other members. If the first peg word is tie, because 1=t or d, the student could imagine a big room filled with many people all with neckties tied around their mouths so they could not talk. The student could construct other images for the other effects. When it came exam time, the student could run down the list of peg words and recall the 10 effects.

How to apply it: First, you would teach the method to students. Then if there are long lists of complex material, you can suggest that students use it. However, methods I will describe later are more useful if there are several groups of things to remember. Later lists tend to interfere with the memory for earlier lists because one is using the same peg-word several times. But there are many situations when you don't care, such as when making grocery lists, lists of errands, or when you want to quickly

learn something by using peg-words and you know you'll use the new list so much you'll eventually get weaned from the pegs. Then this method works fine. There are several methods available for memorizing several lists using pegs. See Bellezza's article for a reference.

C. First-Letter Recoding: When a person takes the first letters of a list of items and arranges them to form an easily remembered word, the person is doing first-letter recoding. To recall the items, you go through the word letter by letter knowing that each letter is the first letter of one of the words. People who learned five Great Lakes (Huron, Ontario, Michigan, Erie, and Superior) by remembering the mnemonic HOMES have used it.

How to apply it: Usually a teacher should work out first-letter mnemonics and simply point out the mnemonics to the students. A teacher can also point out this method to students and suggest that they develop them on other material themselves.

People usually find this technique effective, provided they are reasonably familiar with the long list of items and have recited them. If their learning is shallow, the list of first letters may not work.

D. Story Mnemonic: This begins the section on chain-type methods. In a story mnemonic a person takes the items in a group of things to learn and makes up a story, using the items as he or she comes to them. Obviously people should encode abstract words into other words with higher imagery value to make it easier. It is usually helpful to create a vivid story which has clearcut connections between the incidents that are very natural for the teller to remember. Later one recites the story and the words are there. Research shows that people can usually tell the difference between the words to be memorized and the others which were added to make the story flow.

For example, suppose a geology student wanted to learn the geological periods in order, here's one way he or she could start a story. "I took a walk and came (Cambrian) to a pile of stinking ordure (Ordovician). It was very slippy (Silurian), so I devoted (Devonian) time to getting away from it by going to the Mississippi River (Mississippian). . . ." Incidentally, this brings up the principle that if people will use vivid, exaggerated, or emotionally stimulating material, they can remember it more easily. Therefore, many people use sexual, aggressive, and tabooed behavior when they encode material for story mnemonics.

This technique is very effective. It has an advantage over peg words because students can create new systems on the spot for new material. Expert mnemonists use story mnemonics to remember even long abstract formulas in chemistry, physics, and math. And if you work out some stories for your students and encourage them to work out their own, they can do it, too.

(A side note: While I was writing this passage, I decided I'd use the story method to learn the geologic periods and the five subdivisions of the Tertiary period. For the first time in my life, I've got them memorized; it took just two or three minutes.)

E. The Link Mnemonic: People who use the link mnemonic build overlapping images of a long series of images. The link resembles the way people attach ideas to peg-words, but there are no pegs that are memorized in advance nor are merely two things linked in pairs. Item B is linked to item A; item C is linked to item B; item D is linked to item C, and so on. One takes concepts, encodes them into high-imagery pictures or sounds, and then builds images welding the two into one integrated image.

This is a very important and very useful technique. It has advantages over peg-word systems because, like story methods of remembering, one can develop new systems on the spot.

How to apply it: Usually a teacher only needs to demonstrate the technique on some material from the course and give the students some practice to familiarize themselves with it. It is not practical to develop ready-made links and provide them to students, unless the material is complex and students are unlikely to remember it efficiently.

F. Rhymes and Songs: When people make rhymes and songs that include words and ideas to remember, they find it easier to recall them. The patterns inherent in rhymes and in music provide associations that make remembering new material easier. For example, I would probably forget the spelling rules for words with I and E in them if I had not learned the following rhyme as a high school freshman: "I before E, except after C; or when sounded like A, as in neighbor and weigh. Exceptions: either, neither, weird, seize, and leisure." And I remember the number of days per month with this rhyme: "30 days hath September, April, June, and November. All the rest have 31, except Grandma, and she eats peanut butter." As for songs, many school teachers taught their children the alphabet through the familiar "ABC" song. And advertisers use catchy songs and rhymes to enhance our memory for their products.

How to apply it: Since not many students will spontaneously invent rhymes and songs, their teachers must do the work for them and teach them traditional rhymes and songs (if any exist) in the field being taught. An example of this occurs in medicine. Generations of medical students have learned the 12 cranial nerves in order by reciting "On old Olympus' towering top a Finn and German viewed a hop," or the obscene version, unprintable here.

IV How to Help Students Use Memory Techniques to Learn Better

I have indicated several times that a teacher's

major options are 1) to teach students what the major effective memory techniques are, and 2) to provide them with ready-made mnemonics. I should add that teachers should tell their students that memory techniques are devastatingly effective, quite easy to use, do not require tricky abilities, and are far better than the usual "brute force" methods that most students helplessly rely on. Teachers should urge students to try them. The methods can be taught quickly by using normal teaching methods: state their benefits, explain the principles, demonstrate them, and assign practice. Once students discover how easily they can make long links or stories and remember many items, they will feel very successful and powerful. Their success will motivate them to try more mnemonics on their own.

Students who use good methods of learning can break out of the cycle of low self-concepts, feeble efforts to work in college, poor or failing work, more

discouragement, and giving up. It is up to us to teach them what these methods are. If we don't who will? If we all do, we can see our own teaching productivity rise and the students' learning productivity rise, too.

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OCT 15 1982